PROJECT NUMBER: 6502
PROJECT TITLE: Environmental Tobacco Smoke
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PERIOD COVERED: June, 1988

I. QUANTITATION OF BENZENE AND TOLUENE IN MS AND SS CIGARETTE SMOKE

A. Objective: To determine benzene and toluene MS and SS deliveries of cigarette models with and without $Mg(OH)_2$ paper at 17, 20 and 24.8mm circumference.

B. Results:

The MS deliveries of benzene were 40, 66 and 91 ug/cigt. for the 17, 20 and 24.8 mm circumference control models, respectively, and 47, 65 and 97 ug/cigt. for the 17, 20 and 24.8 mm circumference $Mg(OH)_2$ models, respectively. The MS toluene deliveries (reporting in the same sequence as above) were 60, 100 and 150 ug/cigt. for the controls and 90, 100 and 145 ug/cigt for the $Mg(OH)_2$ models.

The SS deliveries of benzene were 200, 250 and 350 ug/cigt. for the controls and 225, 295 and 410 ug/cigt. for the $Mg(OH)_2$ models. The SS deliveries of toluene were 415, 540 and 800 ug/cigt. for the controls and 435, 560 and 865 ug/cigt. for the $Mg(OH)_2$ models. SS data were calculated based on the amount of tobacco and paper consumed which allowed more precise interpretation of the results.

C. Conclusions: Based on the results obtained from five (5) replicates for each sample, the SS deliveries (mg/g) of the $Mg(OH)_2$ models were lower for toluene and slightly higher for benzene relative to the respective controls. Although these differences are in the range of 5 to 10%, the trends are in opposite directions. The calculation of toluene/benzene ratios for the six (6) samples using SS deliveries in mg/g units revealed that the $Mg(OH)_2$ models have lower ratios relative to their respective controls. These values for toluene/benzene ratios are in excellent agreement with the work reported by Johnson and co-workers (1). In addition, their work showed that the ratios decreased as the tobacco pyrolytic temperature increased. Therefore, the SS benzene and toluene measurements suggest that the $Mg(OH)_2$ paper causes an increase in the tobacco temperature of the cigarette. Static coal temperature measurements show a 30°C decrease for cigarettes made with $Mg(OH)_2$ paper compared to controls, while their are no clear differences in the dynamic coal temperature measurements (2). Physical temperature measurements may not be sensitive or accurate enough to observe the pyrolytic temperature changes suggested by Johnson's "chemical thermometer" (toluene/benzene ratio data). Additional experiments would be required to verify these observations since the data were a result of one model system and also were based on five (5) smoke determinations per sample.

In regards to the effect of circumference on the SS smoke deliveries, it appears that the 17 and 20 mm control models are very similar for both benzene and toluene. The benzene and toluene SS deliveries (mg/g) of these two models are higher than the 24.8 mm control model by 10 and 15%, respectively. A detailed memo will be issued discussing this work.

D. **Plans**: Benzene and toluene measurements will be performed on selected reference cigarettes in support of the SS program. An HP 5880 gas chromatograph should be available in July and it will be set-up and optimized for the procedure.

E. **References**:

1. Johnson, W. R., Hale, R. W., Nedlock, J. W., Grubbs, H. J. and D. H. Powell, "The Distribution of Products Between Mainstream and Sidestream Smoke," TOBACCO SCIENCE, Vol. XVII, pp. 141-144(1973).

2. Oral communication with B. Goodman.

3. Randolph, H. R., P.M. Notebook #8475, p.152.

II. MS AND SS ANALYSES USING TUNABLE DIODE LASER INFRARED SPECTROSCOPY

A. **Objective**: To provide a data base of MS and SS acrolein deliveries for 1988 fabricated 100% single blend component cigarettes.

B. **Results**: The SS deliveries have been determined and for the majority of blend components, the deliveries agree with those previously obtained using the 1984 blend component samples.

C. **Conclusions**: Based on the results of both populations, it appears unlikely that the acrolein SS deliveries can be altered significantly just by changing the percentages of the blend components now being used.

A. **Objective**: Verify earlier observation that acrolein deliveries are reduced with cigarettes having lower glycerine levels in the filler.

B. **Results**: MF blends were fabricated with flavor systems having various levels of glycerine (in cooperation with the Flavor Development Division). A factor of 3 increase in the glycerine content of the filler resulted in a 20% increase in the SS acrolein delivery.

C. **Conclusions**: These results confirm the previous experiments conducted in this project using the TDL acrolein procedure. Based on this work as well as previous work performed at R&D (1), it suggest that acrolein deliveries in SS smoke can be reduced by 10 to 15 % by using blends having low glycerine content (<0.8%).

D. **Plans**: To complete the information required for the data base, the MS deliveries will be measured for the above mentioned blends and the 100% single blend component cigarettes.

E. **References**:

1. Carpenter, R. D., "Acrolein in Cigarette Smoke," Technical Report No. 204,, Nov. 25, 1960.

2. Parrish, M. E., P.M. Notebook # 8617, pp 64-65.

III. Ambient Monitoring of Environmental Tobacco Smoke (ETS)

A. **Objective**: To quantitate the ambient levels of CO, particulates, and nicotine in environmental spaces using portable monitoring systems.

B. **Results**: An ETS study was implemented and completed in the R&D cafeteria. The samples have been analyzed and all data have been compiled for statistical analysis (in cooperation with the Product Evaluation Division).

C. **Conclusions**: The study was conducted with the help of individuals outside of the project and with little disruption in the cafeteria routine. Preliminary evaluation of the data tends to support published data obtained from similarly designed experiments.

D. **Plans**: CO sensors have been modified and new types have been received and will be evaluated for effects due to physical parameters, such as pressure and relative humidity.

E. **References**:

Baker, G., P.M. Notebook # 8504, p. 62.